buckling

Y2(3-5, 8)
6, 7

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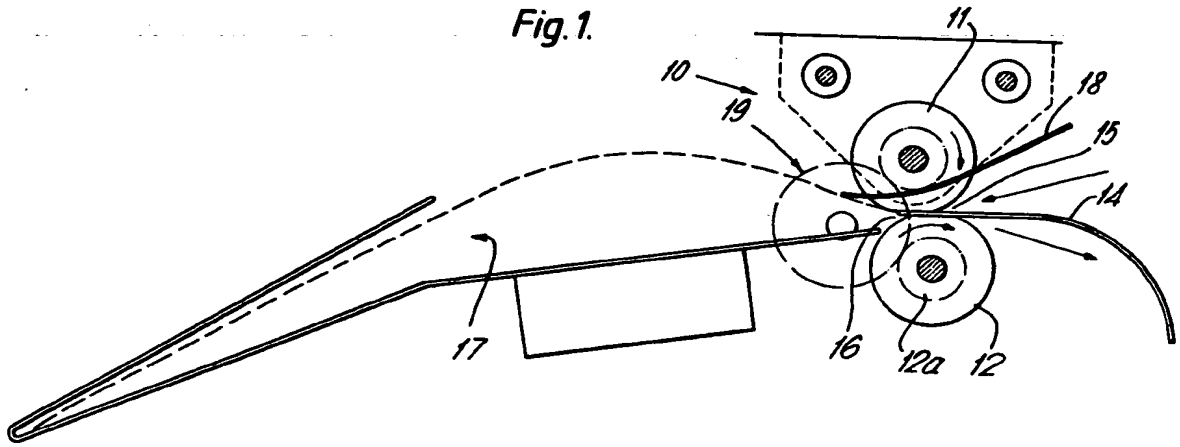
(54) Sheet inverter

(57) A sheet reverser comprises a pair of rollers 11,12 cooperating with a baffle 14 to provide inlet and outlet nips 15,16 associated with a buckle chamber. The rollers are preferably made of foam and are staggered along the baffle. A sheet leaving the inlet nip 15 is buckled by contact with the buckle chamber 17 baffle 14 and guide 18, cooperating to flip the trail edge of the sheet to the other side of the baffle and into the outlet nip, 16. Sheets may be inverted before entering a bin-type sorter from a photocopying machine, Figs. 4,5.

Fig. 1.



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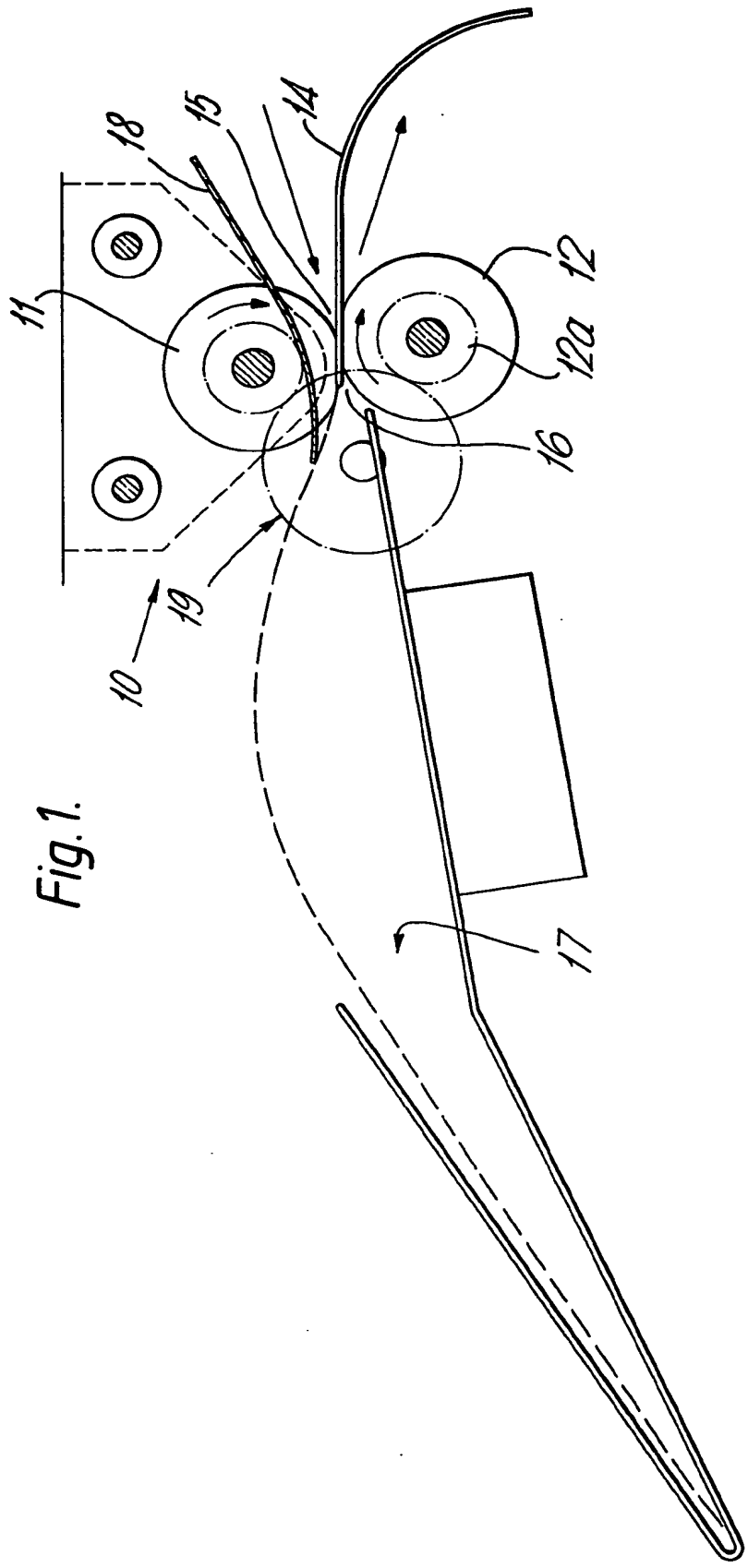
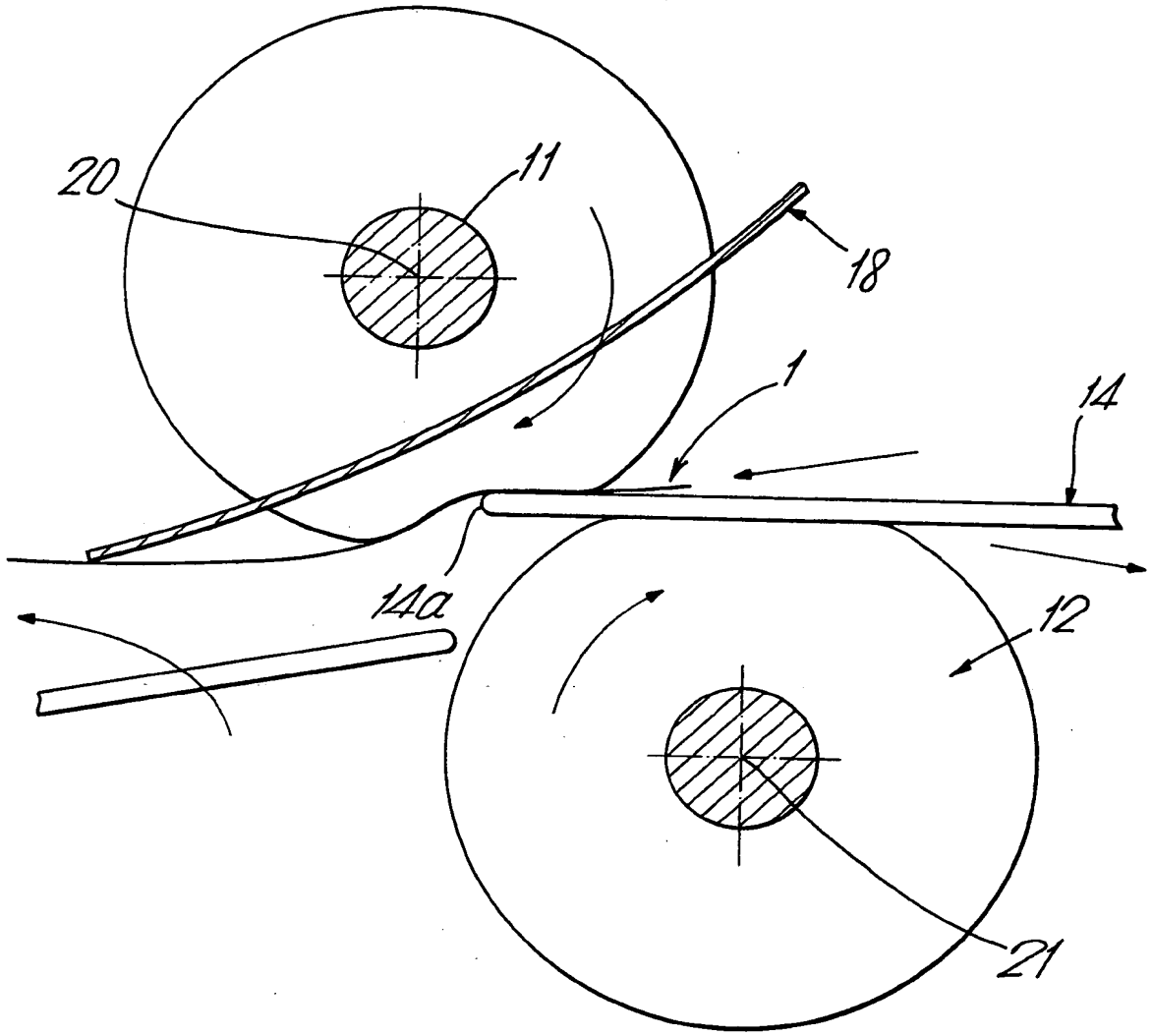


Fig. 1.

Fig.2.



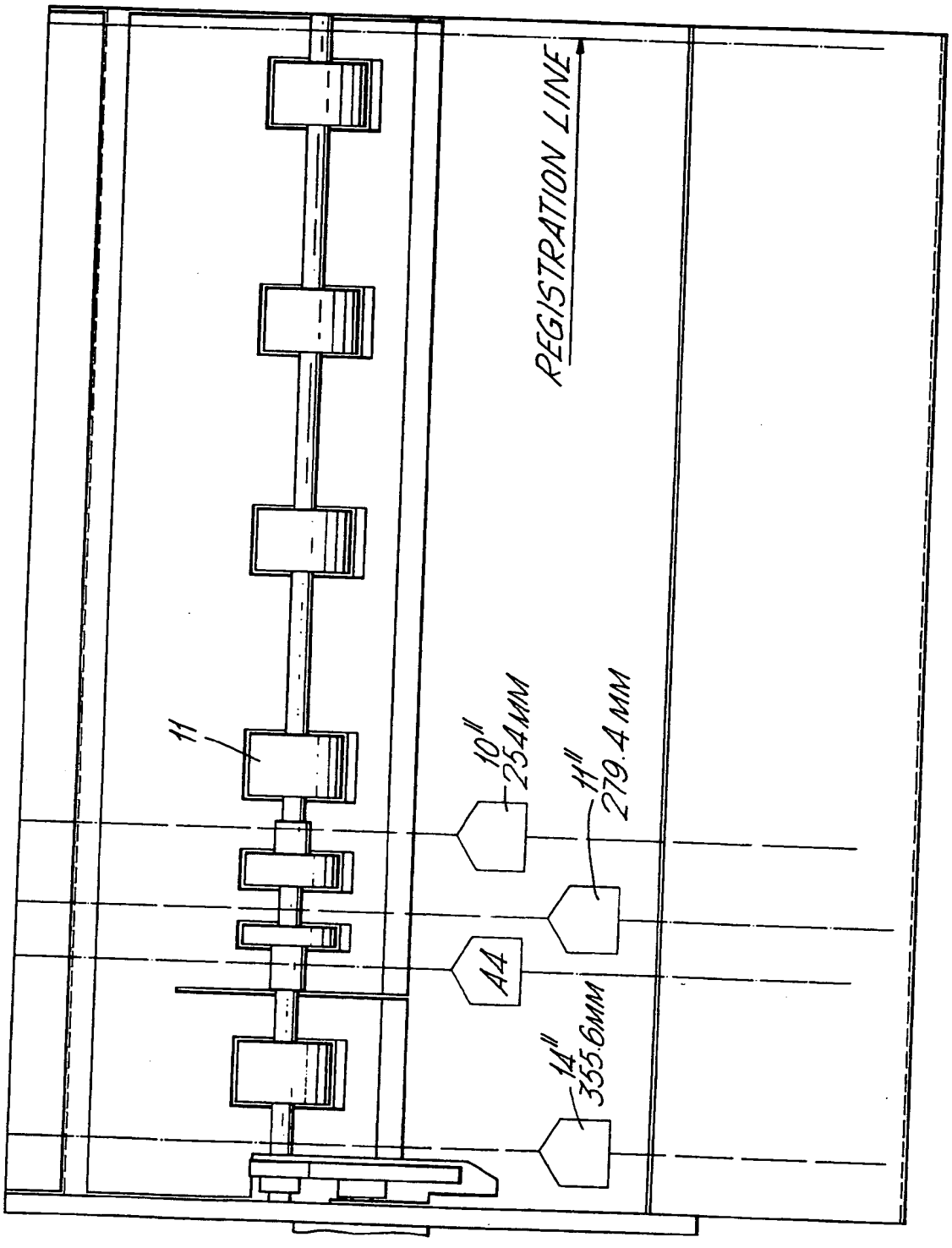


Fig.3.

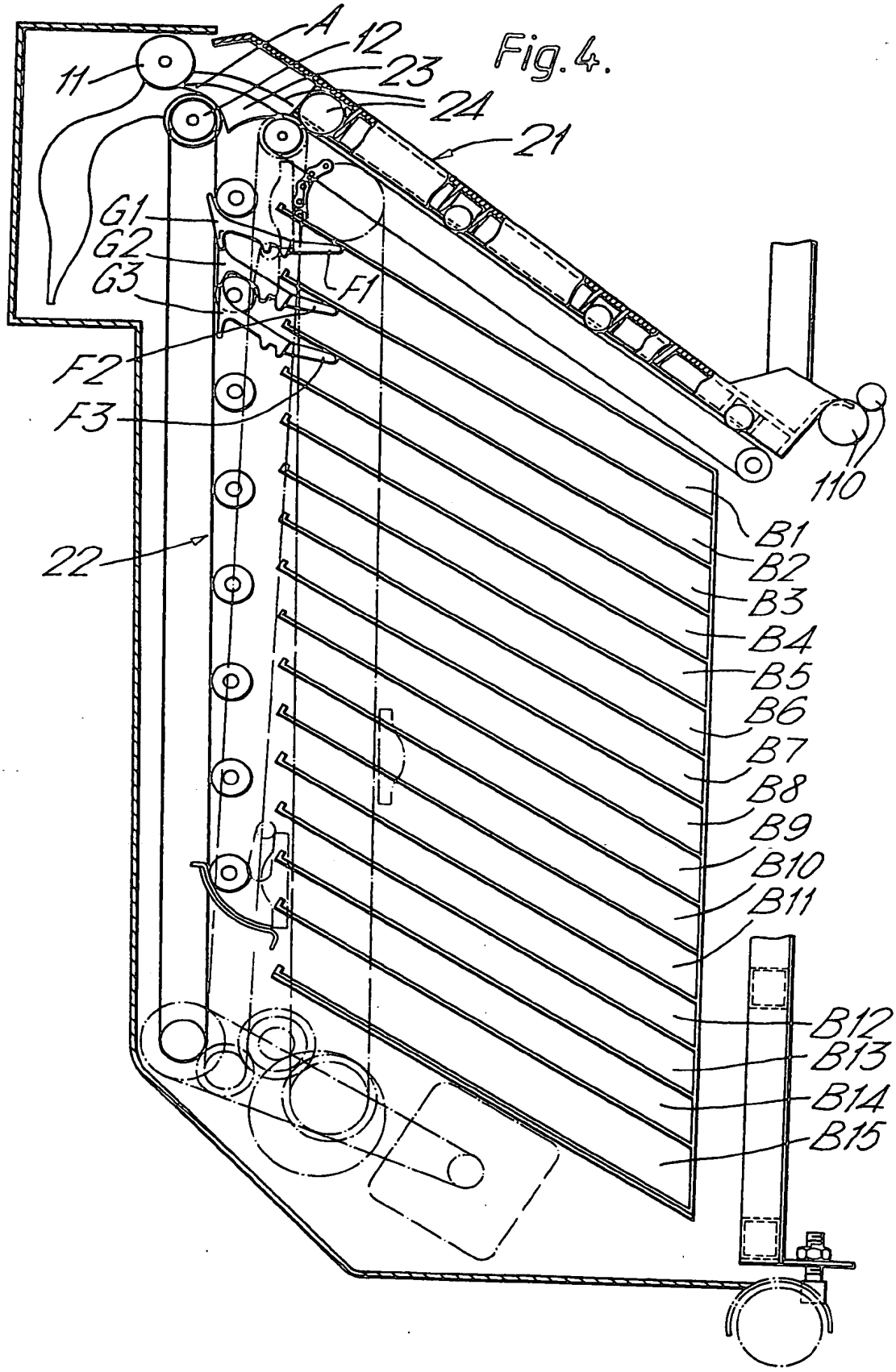
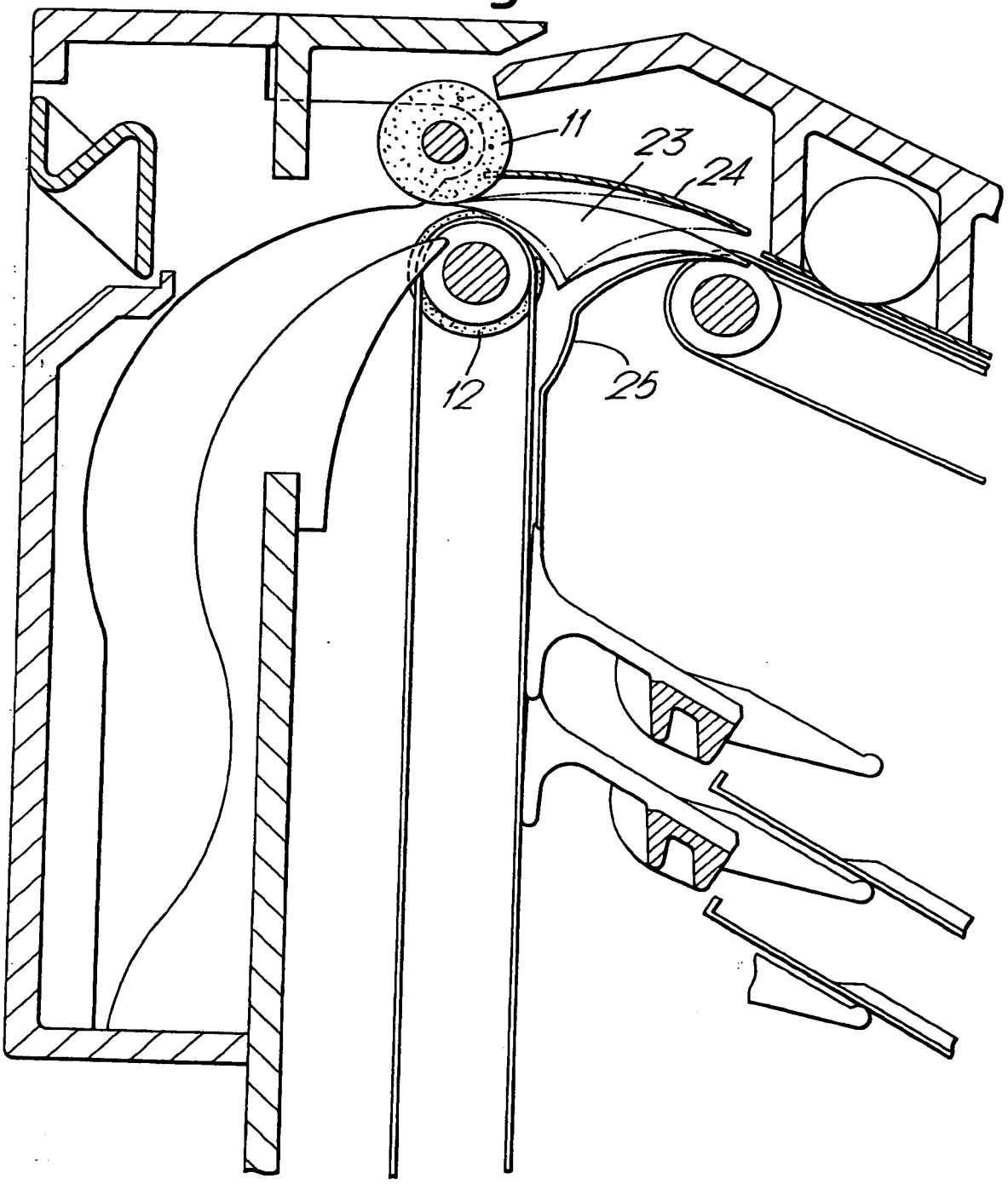

A
12
23
24
21
11
G1
G2
G3
F1
F2
F3
22
110
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12
B13
B14
B15

Fig. 4.

Fig.5.



SPECIFICATION

Sheet-reversing apparatus

This invention relates to sheet-reversing mechanisms, particularly for use in inverting documents. Known sheet-reversing mechanisms used in duplex copying and collating, for example, in electrostatic printing machines, operate by diverting a sheet from its normal path of travel into a reversing station. In withdrawing the sheet from the reversing station the trailing edge becomes the leading edge, the sheet is inverted and then it is returned to its normal path of travel.

Known sheet-reversing mechanisms often use a roller system for driving sheets to and from the reversing station. US Patents 3 944 212, 4 054 285 and 4 214 740 disclose a roller system having a centre drive roll engaging two sets of idler rolls. The centre drive roll engages the first set of idler rolls to convey sheets *seriatim* into the reversing station (such as a bin), and engages a second set of idler rolls to convey sheets away from the bin. The centre roll simultaneously drives both sets of idler rolls either at the same rate as each other as in US 4 054 285 for example, or at a different rate, as in US 4 214 740.

Thus the prior art discloses sheet-reversing apparatus including input and output rollers which cooperate with a common member respectively to form input and output nips for conveying sheets into and out of a reversing station wherein sheets are transferred from said input nip to said output nip.

A sheet-reversing mechanism according to this invention is characterised in that the common member is a stationary baffle having opposed faces respectively contacted by input and output rollers. Such an arrangement has fewer moving parts than known systems. Because the distance between the input and output nips is reduced, higher speed operation is possible.

In a preferred embodiment the baffle terminates in a edge facing the reversing station, and the rollers are foam rollers arranged so that the input roller has its nip over the edge, and the output nip is spaced back from the edge. The reversing station comprises a buckle chamber adapted to buckle a sheet delivered thereto from the input nip, so that the trail edge of the sheet is conveyed into the output nip. In its basic form the baffle suitably comprises a flat plate but may take other forms. The apparatus may also comprise a deflection member.

In order that the invention may be more readily understood, reference will now be made to the accompanying drawings in which:–

Figure 1 is a schematic side elevation of a sheet reversing apparatus according to the invention;

Figure 2 shows a detail on an enlarged scale;

Figure 3 is an end elevation seen from the input side;

Figure 4 is a side elevation of a sorter or collator incorporating a sheet reversing mechanism according to the invention, and

Figure 5 is an enlarged side elevation or view of the sheet reversing mechanism shown in Fig. 4.

Referring to Figs. 1 to 3, there is shown a sheet-reversing mechanism 10 according to this invention, comprising a plurality of input rollers 11 and output rollers 12, which cooperate with a common baffle member 14 respectively to form input and output nips 15, 16. As shown in Fig. 3, the baffle ends across the width of the paper path and the rollers 11 and 12 are arranged at spaced intervals thereacross. The input and output nips 15, 16 serve to convey sheets into and out of a reversing station 17, wherein the sheets are transferred from the input nip 15 to the output nip 16. To this end, the baffle 14 (which is in the form of a sheet metal plate) terminates in an end 14a facing the reversing station. In operation, trail edge of a sheet in the reversing station is deflected past end 14a.

The reversing station takes the form of a buckle chamber arranged and dimensioned such that a sheet entering the chamber is buckled as shown in dotted lines in Fig. 1 that the trail edge exiting the input nip 15 is deflected into the output nip 16 and becomes the lead edge of the inverted sheet. The buckle chamber suitably is J-shaped in cross-section, and is formed from sheet metal.

The baffle member may also act as a guide for the sheets being extracted from the apparatus as shown in Fig. 1, its being arranged to turn a sheet exiting the nip 16 downwardly through 90°. A guide 18 is provided for assisting in deflection of the trail edge of a sheet arriving at the reversing station into the nip 15.

The rollers 11 and 12 are driven through a common drive gear 19 engaging gears 12a on the drive shafts 20, 21 of the input and output rollers 11, 12 respectively.

In the embodiment illustrated in greater detail in Fig. 2, the rollers 11 and 12 are foam rollers made for example of foamed plastics material. The axes 20, 21 of the input and output rollers are offset along the direction of sheet movement, and are positioned with respect to the baffle plate 14 so that they are deformed. The axis of roller 20 is slightly beyond the end 14a of the plate 14, so that the outer surface of the roller is deformed about the end 14a. This arrangement assists in guiding and deflecting the trail edge of the sheet into the output nip. Each output roller 12 is set back from the edge 14a of the plate 14 to form a clearly-defined output nip 16 and to

avoid direct contact between the input and output rollers 11, 12.

In operation a sheet travelling generally downwardly past the right-hand side of the sheet-reversing mechanism as illustrated in Fig. 1 is directed into the input nip 15 between the roller 11 and the baffle plate 14. The sheet is driven by the roller 11 into the buckle chamber 17. The dimensions of the buckle chamber are such that the lead edge of the sheet contacts the end of the buckle chamber while the trail edge of the sheet is still within the nip 15. This causes the sheet to buckle upwardly as shown in Fig. 1, but as the trail edge of the sheet leaves the nip 15 it is deflected by the beam strength of the buckled sheet into the output nip 16. As it enters the output nip 16, the roller 12 grips the sheet and pulls it out of the reversing station. The curved extension of the baffle 14 serves to redirect the sheet along an output path extending at an angle to its original path. The sheet is now however inverted, with the previous trail edge now becoming the lead edge, and the opposing faces of the sheet reversed.

A sheet-reversing mechanism as described above may be used in an electrostatographic printing machine providing duplex copying, and it may be used for inverting duplex documents in a recirculating document handler. Alternatively, it may be provided in the copy sheet path for inverting sheets which have received an image on one side, prior to being re-fed to receive an image on the other side.

While a passive sheet-reversing station has been described, this could be replaced by a station having positive drive means, such as illustrated for example in US 4 054 285 and US Reissue 944 212.

Another embodiment of a sheet-reversing mechanism according to the invention is illustrated in Figs. 4 and 5. In this embodiment, the sheet-reversing mechanism is utilised in a sheet sorter or collator for inverting sheets being delivered from a copier into the bins of the sorter. As shown in Fig. 4, the sorter comprises fifteen bins B1–B15 into which sheets are fed by an inclined sheet transport 21, which extends across the top of the sorter. The output of a xerographic copier is represented here by output nip rolls 110. A vertical trnsport 22 extends downwardly past the entrances of the bins. Sheets are deflected in the bins by deflectors or gates G which are pivotally mounted for movement between an active position (gate G1) and an inactive position (see gate G2, G3). Bin lift fingers F with the respective gates enlarge the bins B2–B14 by engaging the underside of the upper bin plate to lift it. In its active position, the gate G collects the lead edge of a sheet travelling along the transport 22 and guides it into the associated bin. The gates G are actuated by cams on a chain drive.

The deflector 23 between transports 21 and 22 is pivotable between a first position, shown in dotted lines in Fig. 5, in which sheets are diverted into the vertical transport 22, and a second position shown in full lines in Fig. 5 in which sheets are diverted into the sheet-reversing mechanism 10. As shown in Fig. 5, the sheet-reversing mechanism includes input roller 11 and output roller 12. When the diverter is in its solid-line position sheets are diverted to the sheet-reversing station, with the edge A of the diverter is pressed against the circumference of the input roller and the output roller is pressed against the curved deflection surface of the diverter.

In order to perform its functions, the diverter is generally triangular in cross-section and has curved guide surfaces.

Guide plates 24 and 25 respectively assist in guiding sheets into the reversing mechanism and the vertical transport respectively. As in the embodiment previously described, the sheet-reversing station 17 comprises a buckle chamber dimensioned and shaped to transfer the trail edge of a sheet into the output nip 16 as it leaves the input nip 15. In this embodiment the buckle chamber is generally S-shaped in cross-section. In operation sheets may either be fed directly to the bins, with the diverter positioned to connect the transport 21 direct to the transport 22, or conveyed between the transport 21 and 22 *via* the sheet-reversing mechanism 10, in which case the sheets are inverted so that their trail edges become their lead edges and their opposing faces are reversed. In this way the sorter is particularly suited for handling both simplex and duplex copies leaving the associated copier.

CLAIMS

1. Sheet-reversing apparatus, including input and output rollers which cooperate with a common member respectively to form spaced-apart input and output nips for conveying sheets into and out of a direction-reversing station, whereby the trail edge of each sheet entering the reversing station is transferred from the input nip to the output nip, the common member being a baffle having opposed faces respectively engaged by the input and output rollers.

2. Sheet-reversing apparatus according to claim 1, wherein the baffle terminates in an end facing the reversing station, and the rollers are arranged with the input roller overlying the end, and the output nip set back from the end.

3. Sheet-reversing apparatus according to claim 1 or 2, wherein the rollers are deformable, being preferably made of foam.

4. Sheet-reversing apparatus according to any preceding claim, wherein the baffle is a flat plate.

5. Sheet-reversing apparatus according to any of claims 1–3, wherein the baffle is a

generally-triangular, optionally-curved, pivoted member.

6. Sheet-reversing apparatus according to any preceding claim, wherein the reversing station comprises a baffle chamber adapted to buckle a sheet delivered thereto from the input nip so that the beam strength of the buckled sheet is used to deflect the trail edge of the sheet into the output nip.

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